M/027/007

WESTERN STATES MINERALS CORPORATION

February 4, 1999

FROM: James Ashton (jwa@wsmcgold.com)
TO: Mark Novak (mnovak@deq.state.ut.us)
Cc: NROGM.TMUNSON@state.ut.us; NROGM.WHEDBERG@state.ut.us; DFREDERI@deq.state.ut.us

Subject: Response to Mr. Novak's E-mail sent Friday, January 29, 1999.

First, WSMC's server could not complete the transfer of the new Table B-1 worksheet. I will try and send this table along with the answer to your questions.

The initial moisture content used in the HELP modeling was the initial moisture as measured in the lab. The units on Table B-1 are in percent, where as the units used in the HELP modeling require a vol/vol basis.

I ran the HELP model for HG-1 without a liner. The model was run long enough in order to achieve a steady-state condition. The steady-state condition was reached in all scenarios when the volume of water in the heap reached roughly 89 inches. The table below lists the results from the modeling.

HYDROLOGIC INVESTIGATION OF HG-1 WITHOUT A LINER

DESCRIPTION	Years to Reach Steady-State	Average Yearly Outflow after Steady-State	Year First Effluent Appears
Case#1: Above Average Precipitation, No Topsoil	11	645,183 gal	9
Case#2: Average Precipitation, No Topsoil	17	427,290 gal	14
Case#3: Above Average Precipitation, Topsoil (6 inches)	27	292,154 gal	23
Case#4: Average Precipitation, Topsoil (6 inches)	39	13,307 gal	31

Parameters used in the modeling are as follows:

Average precipitation is estimated to be 7.79 inches per year.
Above average precipitation, obtained by using actual data years 1978 to 1987) is 10.08 inches per year.
Initial moisture was set to that measured in the lab.

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From the table, it is seen that leachate will be produced in the future for all scenarios. The meteoric water mobility procedure results indicate that the quality of the effluent will be only minimally above the standards for pH, arsenic and iron. The use of topsoil on the pad greatly reduces the amount of leachate and increases the time until leachate will first appear. In the worst case scenario, a total of 645,183 gallons per year or 1.23 gallons per minute is predicted to flow out of the pad. This is a very small flow with only slightly elevated constituent levels.

Solution application to the leach pads was discontinued in 1990. Since that time, the pads have been left to drain. During the time period between 1991 and 1998, the average annual precipitation as measured at Delta, Utah was 9.07 inches. At the time solution application was discontinued, the moisture within pads would be considered to be or very close to field capacity. Yet, over the last 8 years, the pads have drained down, precipitation has been greater than normal, and effluent from the pads is nonexistent, except Pad 4&5. The HELP model would have predicted continuous effluent flowing from the pads given that the starting condition was at or near field capacity.

It was suggested in a paper written in 1951, "Ground Water in Ruby Valley, Elko and White Pine Counties, Nevada", by T.E. Eakin and G.B. Maxey, that no significant ground-water recharge is believed to occur in areas having precipitation of less than 8 inches. The observance of no leachate flowing from the pads would suggest this to be valid. Thus, the possibility of degrading the waters of the state is very low.

If you need more information please give me a call at 775-856-3339 or e-mail me at jwa@wsmcgold.com.

Sincerely,

Jim Ashton
Senior Project Engineer

TABLE B-4
WESTERN STATES MINERALS CORPORATION
SOIL CHARACTERIZATION RESULTS

	PARAMETER	Limit mg/l	HG1 EDGE	HG2 EDGE	HG3 EDGE	HG6 EDGE	SOIL #1	SOIL #2	SOIL #3	SOIL #4	SOIL #5	SOIL #6	SOIL #7	SOIL #8	SOIL #9
Meteoric Water Mobility Procedure - Solution Analysis	pH	6.5-8.5	8.07	8.36	8.18	8.38									
	Alkalinity, CaCO3		142	165	173	140									
	Bicarbonate		173	189	211	171									
	Aluminum		0.53	0.35	0.5	<0.025									
	Antimony		<0.003	<0.003	<0.003	<0.003									
	Arsenic	0.05	<0.005	<0.005	0.029	0.054									
	Barium	2	0.15	0.06	0.08	0.03									
	Beryllium		<0.001	<0.001	<0.001	<0.001									
	Boron		2.1	2.2	0.14	0.3									
	Cadmium	0.005	<0.003	<0.003	<0.003	<0.003									
	Calcium		580	140	250	9									
	Chloride	250	2130	180	1215	130									
	Chromium	0.1	<0.01	<0.01	<0.01	<0.01									
	Copper	1.3	<0.01	0.01	0.02	0.01									
	Fluoride	2	1.8	1.5	0.56	0.69									
	Iron	0.3	<0.05	<0.05	<0.05	<0.05									
	Lead	0.015	<0.002	<0.002	<0.002	<0.002									
	Magnesium	125	75	12	39	1									
	Manganese	0.05	<0.01	<0.01	<0.01	<0.01									
	Mercury	0.002	<0.0002	<0.0002	<0.0002	<0.0002									
	Nickel		<0.01	0.02	0.04	<0.01									
	Nitrate Nitrogen	10	30	12	<1	1.2									
	Nitrite Nitrogen		<0.5	<0.5	<0.5	<0.5									
	Potassium		28	23	10	13									
	Selenium	0.05	<0.005	<0.005	<0.005	<0.005									
	Silver	0.1	<0.01	<0.01	<0.01	<0.01									
	Sodium		170	840	860	78									
	Sulfate	250	1940	1930	780	100									
	Thallium		<0.001	<0.001	<0.001	<0.001									
	TDS	500-1000	6600	3380	3410	430									
	Cyanide, WAD	0.2	0.072	<0.005	0.01	0.012									
	Zinc	5	<0.05	<0.05	<0.05	<0.05									
	Bismuth		<0.5	<0.5	<0.5	<0.5									
	Cobalt		<0.5	<0.5	<0.5	<0.5									
	Gallium		<0.5	<0.5	<0.5	<0.5									
	Lithium		<0.5	<0.5	<0.5	<0.5									
	Molybdenum		<0.25	<0.25	<0.25	<0.25									
	Phosphorus		0.84	0.77	<0.5	0.98									
	Scandium		<0.5	<0.5	<0.5	<0.5									
	Strontium		6.4	1.7	2.8	<0.5									
	Tin		<0.5	<0.5	<0.5	<0.5									
	Titanium		<0.1	<0.1	<0.1	<0.1									
	Vanadium		<0.15	<0.15	<0.15	<0.15									
Growth Media Testing	Soil Test Results:														
	Texture						Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Loamy Sand	Loamy Sand	Sandy Loam	Sandy Loam
	Lime						Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
	pH						8.2	8	8.7	8.4	8.1	7.9	8.5	8	8.1
	Salinity - ECe (mmhos/cm)						0.4	0.4	0.7	5.6	0.3	4.6	1.4	20	1.4
	Phosphorus						2.2	1	2.5	1.3	1.9	1.6	1.6	3.2	2.4
	Potassium						174	80	97	81	179	46	111	57	218
	Nitrate - Nitrogen						2.8	1.5	1.5	9.3	1.5	1.3	5.2	6	24.2
	SAR						3	0.69	15	24	2.36	7.58	15	36	2.78
	Organic Matter, %						0.76	0.68	0.51	0.43	0.83	0.31	0.58	0.49	0.51
	CEC, meq/100g						16.2	13.8	19.5	12.3	15.9	30.1	21	9.3	9.3
	Sodic						NO	NO	YES	YES	NO	NO	YES	YES	NO

Note: Shading indicates an exceedance